



First stage

First semester

Workshops

Metal casting processes

Lecture: 3

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Pattern

2. The shrinkage allowance depends on the coefficient of thermal expansion of the material (α). A simple relation indicates that higher the value of α , more is the shrinkage allowance.
3. For a dimension ' l ', shrinkage allowance is $\alpha l (\theta_f - \theta_0)$. Here θ_f is the freezing temperature and θ_0 is the room temperature.
4. **Machining allowance:** will take care of the extra material that will be removed to obtain a finished product. In this the rough surface in the cast product will be removed. The machining allowance depends on the size of the casting, material properties, material distortion, finishing accuracy and machining method.

Machining allowances of various metals

Metal	Dimension (inch)	Allowance (inch)
Cast iron	Up to 12	0.12
	12 to 20	0.20
	20 to 40	0.25
Cast steel	Up to 6	0.12
	6 to 20	0.25
	20 to 40	0.30
Non ferrous	Up to 8	0.09
	8 to 12	0.12
	12 to 40	0.16

5. Draft allowance:

All the surfaces parallel to the direction in which the pattern will be removed are tapered slightly inward to facilitate safe removal of the pattern. This is called '**draft allowance**'.

General usage:

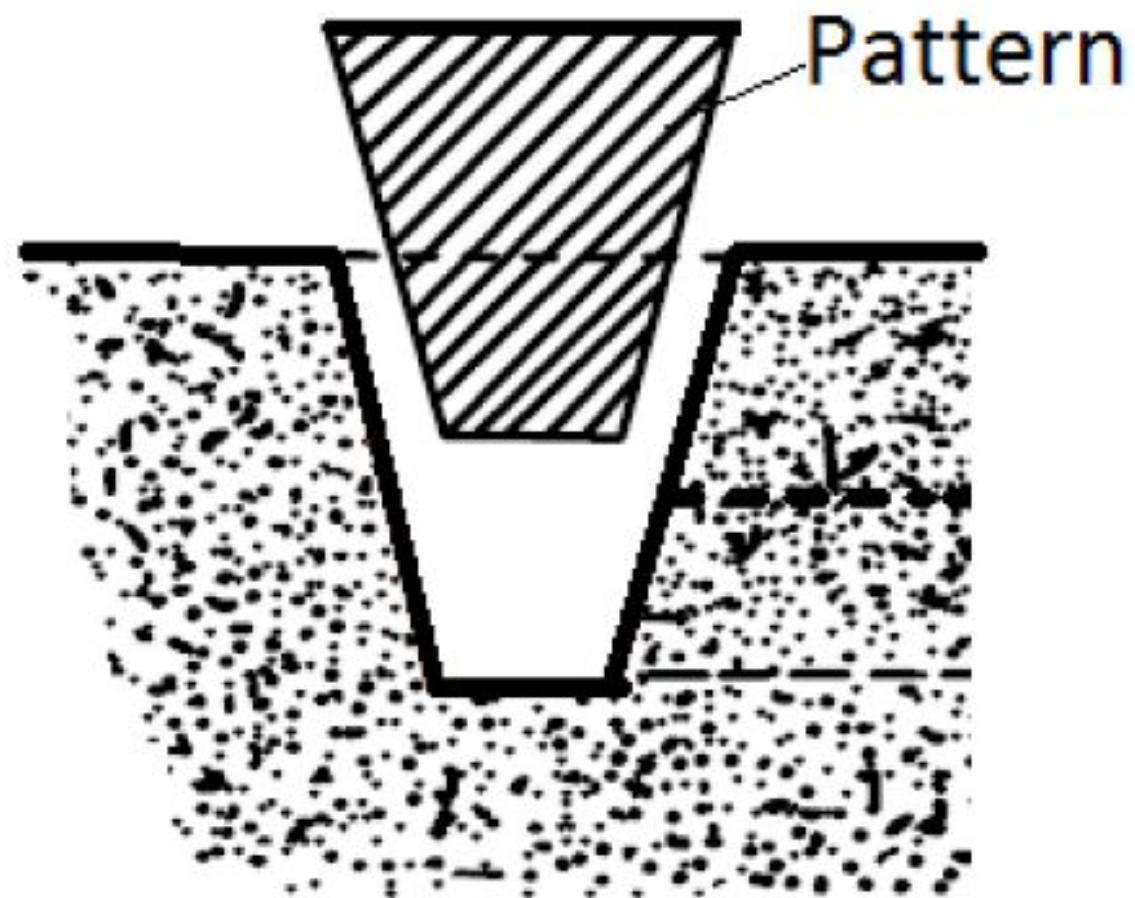
External surfaces ; Internal surfaces, holes, pockets

Typical Draft Allowances

Pattern material	Height of the given surface (inch)	Draft angle (External surface)	Draft angle (Internal surface)
Wood	1	3.00	3.00
	1 to 2	1.50	2.50
	2 to 4	1.00	1.50
	4 to 8	0.75	1.00
	8 to 32	0.50	1.00
Metal and plastic	1	1.50	3.00
	1 to 2	1.00	2.00
	2 to 4	0.75	1.00
	4 to 8	0.50	1.00
	8 to 32	0.50	0.75

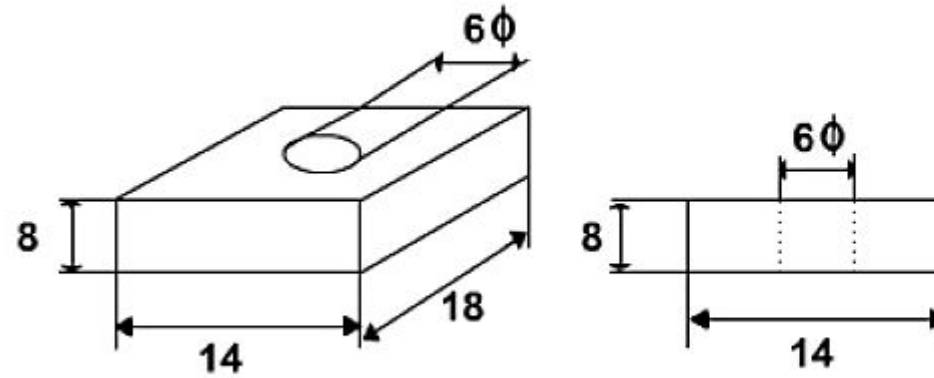
cracks

Pattern having no draft on vertical surfaces

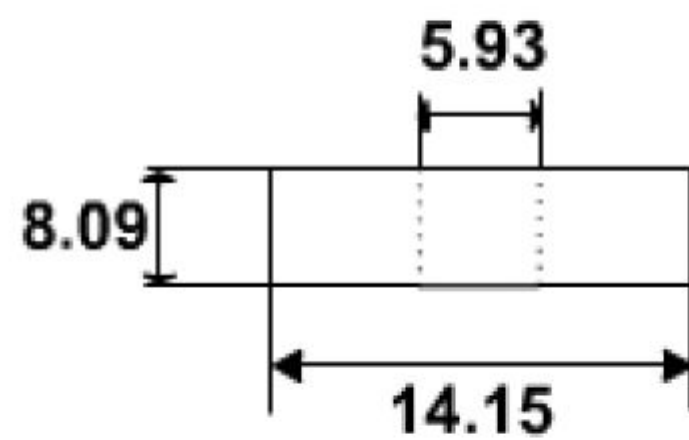
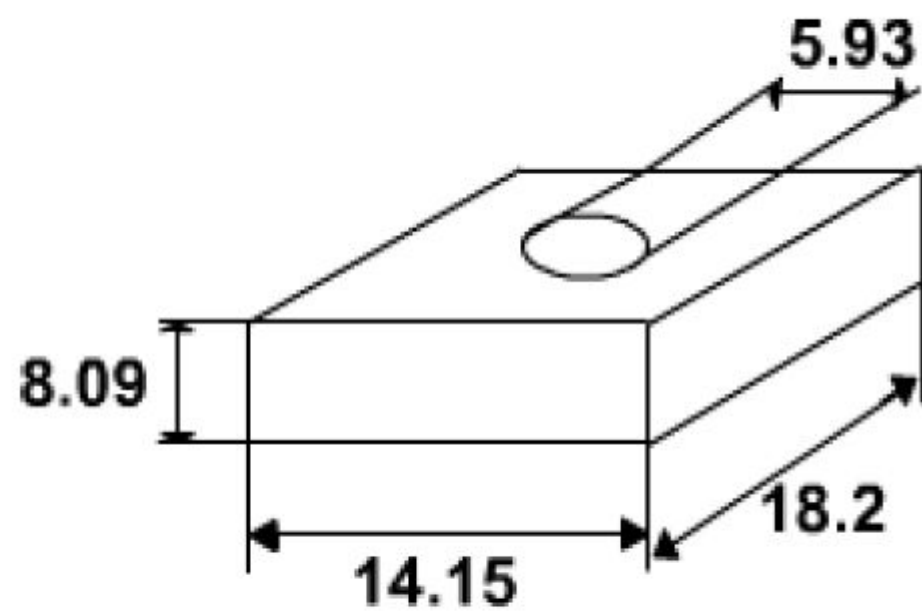


Pattern having draft allowance on vertical surfaces

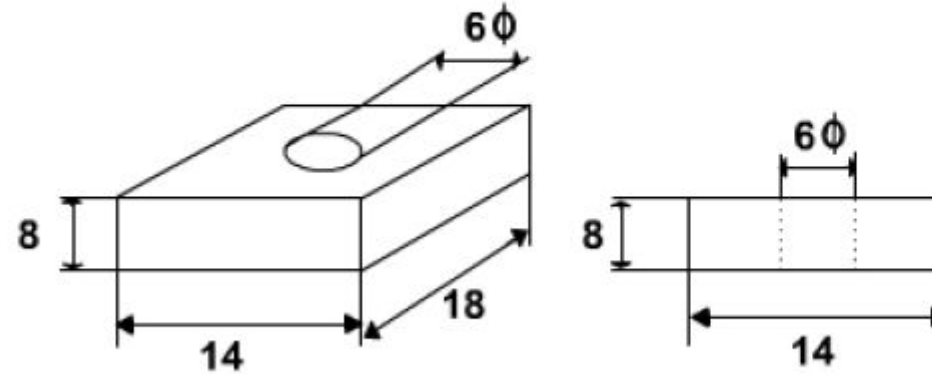
The casting shown is to be made in CI using a wooden pattern. Assuming only shrinkage allowance, calculate the dimensions of the pattern. **All dimensions are in inches**



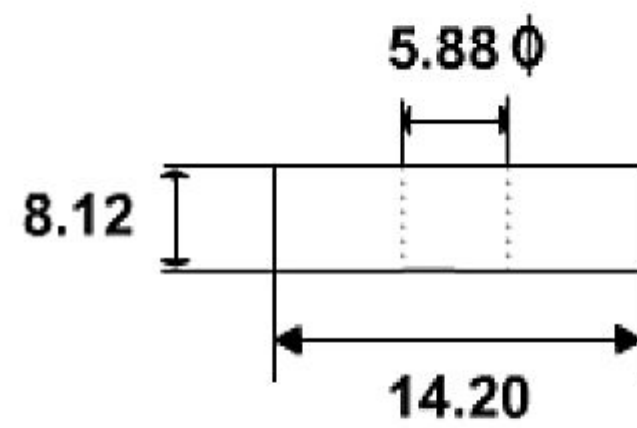
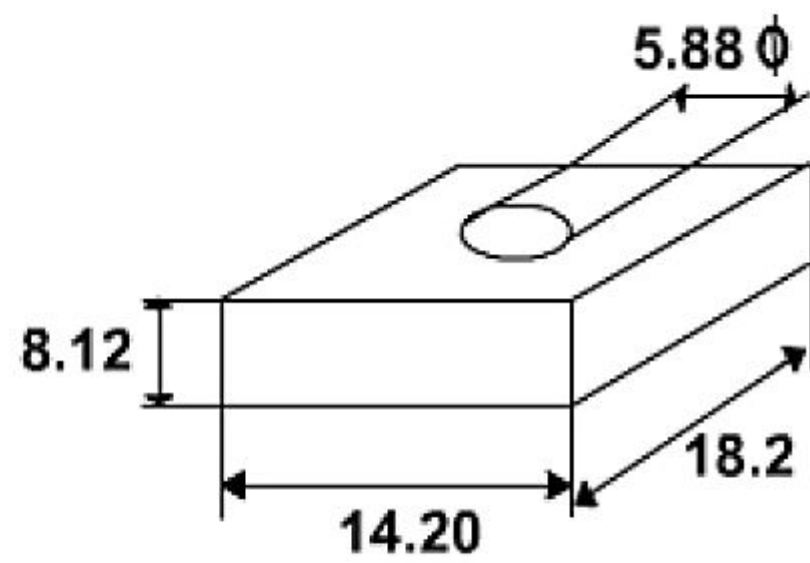
Material	Dimension	Shrinkage allowance (inch/ft)
Grey Cast Iron	Up to 2 feet	0.125
	2 feet to 4 feet	0.105
	over 4 feet	0.083
Cast Steel	Up to 2 feet	0.251
	2 feet to 6 feet	0.191
	over 6 feet	0.155
Aluminum	Up to 4 feet	0.155
	4 feet to 6 feet	0.143
	over 6 feet	0.125
Magnesium	Up to 4 feet	0.173
	Over 4 feet	0.155



The casting shown is to be made in CI using a wooden pattern. Assuming only machining allowance, calculate the dimension of the pattern. All dimensions are in Inches

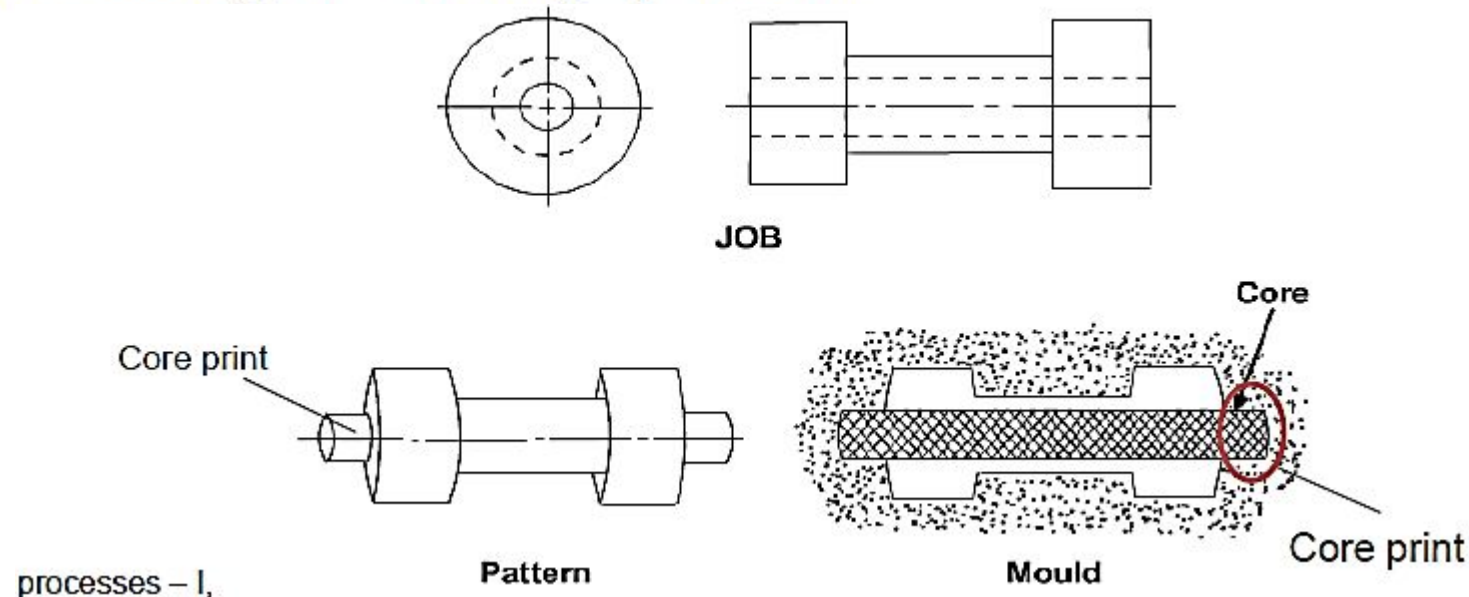


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6. Core and core print:

- Cores are used to make holes, recesses etc. in castings
- So where coring is required, provision should be made to support the core inside the mould cavity. **Core prints are used to serve this purpose.** The core print is an added projection on the pattern and it forms a seat in the mould on which the sand core rests during pouring of the mould.
- The core print must be of adequate size and shape so that it can support the weight of the core during the casting operation.

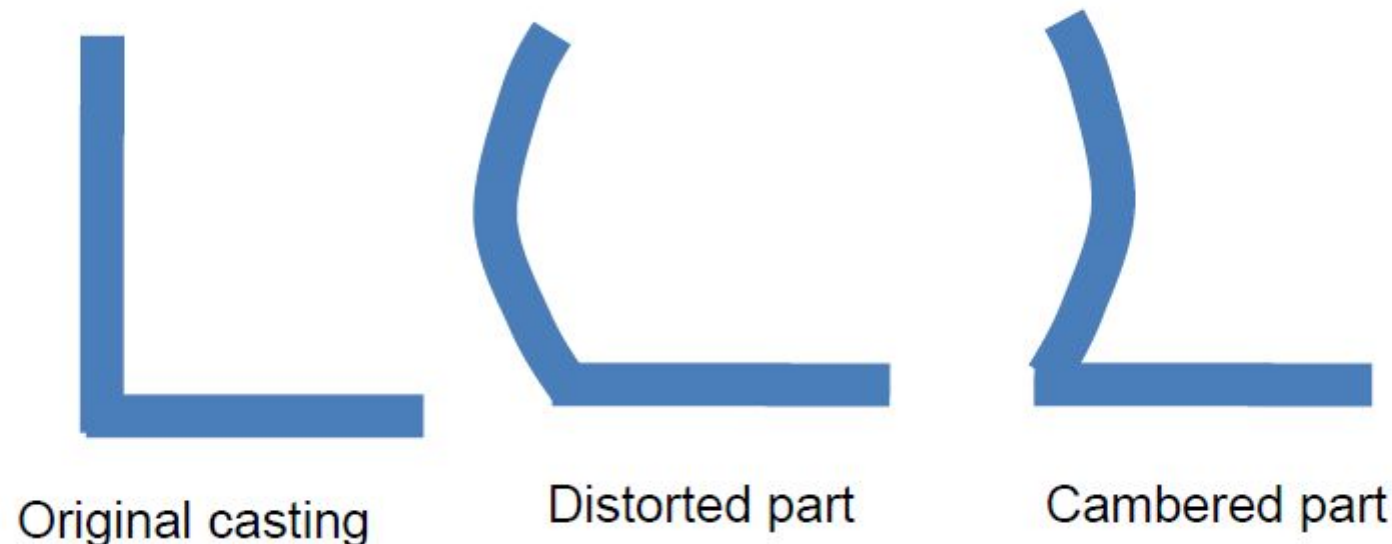


7. Distortion allowance (camber)

- Vertical edges will be curved or distorted
- This is prevented by shaped pattern converge slightly (inward) so that the casting after distortion will have its sides vertical
- The distortion in casting may occur due to internal stresses. These internal stresses are caused on account of unequal cooling of different sections of the casting and hindered contraction.

Prevention:

- providing sufficient machining allowance to cover the distortion affect
- Providing suitable allowance on the pattern, called camber or distortion allowance (inverse reflection)



8. The tapped hole and slot will not be sand cast. They will be made by machining operations.
9. The pattern shown is made in two halves which are located by dowel pins. This is called '**split pattern**'.
10. **Pattern material**: wood => light, easily workable, minimum tendency for checking and warping

